

FARMERS' PERCEPTION ON ENVIRONMENTAL EFFECTS OF PESTICIDE USE, CLIMATE CHANGE AND STRATEGIES USED IN MOUNTAIN OF WESTERN HIMALAYA

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ABSTRACT

The study was conducted to evaluate farmers' perception on environmental effects of pesticide usage in Indian mountain of Western Himalayan state of Himachal Pradesh. The study was based on primary data collected from the farmers who involved in pesticides use in high value cash crops like apple and vegetables. The perception on various aspects of pesticide usage revealed that those farmers who had large farm size have more awareness for the usage of pesticides than those who had small farm size. All small land holding and majority of large land holding farmers were dependent only on farming for their livelihood. Hence, to increase their production farmers were doing excessive and indiscriminate use of pesticides. On all farm, more than four fifths of the farmers responded that productivity was decreasing and 94.51 per cent of the farmers responded that cost of production was increasing. In comparison to large farmers, response of small farmers was less for adopting some of the strategies to minimize adverse effect of climate change and loss of natural resource base. The study concluded that all the farmers those who had awareness and those who don't have awareness on the impact of pesticide use were underestimating the use of pesticides which make an increase in agricultural production and productivity and have adverse effect on the human health and the ecosystem. Therefore, the message of the study is clear. There is a need to pay attention towards promoting scientific and rational use of pesticides and other agro-chemicals to avoid environmental effects and to promote balanced use of fertilizer including bio-fertilizer for restoring soil health to protect the livelihoods of multitude of small and large farmers. The government should, therefore, undertake policy measures to strengthen extension facilities to educate specifically small size farmers about environmental effects due to the use of agro-chemicals.

KEYWORDS Awareness, Pesticides, Environment, Rational Use of Pesticides & Natural Resource Base

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INTRODUCTION

Pesticide use in most of the developing countries is reported to be unscientific and unregulated, causing serious damages to the ecosystem and human health. The trade-off between the health impacts and financial benefits of crop production have been reported by various researchers across the globe (Rola and Pingali, 1993; Pingali *et al.*, 1994; Antle and Pingali, 1994; Crissman *et al.*, 1994). Despite this, pesticide use policies and regulations are in their infancy in many developing countries and as a result, pesticide misuse is prevalent (Tjornhom *et al.*, 1997). Pimental, (1995) estimated that only 0.1 per cent of applied pesticides reach the target pests, leaving the bulk of the pesticides (99.9 per cent) to impact the environment. Hence, Integrated Pest

Management is an ecosystem-based strategy that provides economical, long-term solutions to pest problems through a combination of biological, cultural, physical and chemical controls. With IPM, pesticides were used only after crop monitoring indicates that they were needed, thus minimizing negative impacts on humans and ecosystem (Flint and Goveia, 2001). The different studies revealed that excessive and indiscriminate use of pesticides led to adverse impact on environment such as human health, soil and biodiversity and decline in the productivity of crops (Devi, 2009; Kumari and Sharma, 2014; McLaughlin and Mineau, 1995; Partap 2003; Shetty, 2004 and Dasgupta and Meisner *et al.*, 2005). This paper has analyzed the awareness regarding pesticide use and handling, sources of information for pesticide application, changes in productivity and production, change in parameters of climate and strategies adopted by the farmers to minimize the loss of natural resource base.

METHODOLOGY

The Kullu district was purposively selected, out of 12 districts of the state of Himachal Pradesh for the study. The selection of the districts was done, because in the district the cultivation of high value crops namely apple and seasonal and off-seasonal vegetable is being practiced since the late sixties and early seventies. Kullu block in Kullu district was purposively selected for the study. Thereafter, a list of panchayats falling in the selected block was prepared. In the next stage of the sampling, one panchayat from the selected block was randomly selected. The selected panchayat was Jallugran from the Kullu block. Later on the list of the villages falling in the selected panchayat was prepared. Thereafter, 50 per cent of the villages were selected randomly from the selected panchayat. In selected panchayat, hundred households were allocated among the selected villages through a proportional allocation method. Thus, the total sample size consists of 100 households. The data was collected from the pesticide applicator from each house household. The farmer who was doing the spray in high value cash crops (apple and vegetables) for most of the time and for the last many years considered pesticide applicator (Kumari & Sharma, 2014). For the construction of strata, cumulative square root frequency method was used (Singh and Mangat, 1995). The small farm includes those farmers who had land ≤ 2.08 ha and the large farm includes those farmers who had land more than 2.08 ha. Therefore, out of selected 100 farmers, 90 farmers who had small farm and 10 farmers who had large farm. The study is based on primary data. The primary data was collected from the pesticide applicator of sample households by using a pre-tested schedule through a personal interview method for the agricultural year 2005-2006. The data has been presented through percentage and bar diagram.

RESULTS & DISCUSSIONS

The six statements that measured the respondents' level of awareness about impact of pesticides on health and symptoms of poisoning (Table 1). On all farm, all the sample households reported that contact with pesticides cause eye injuries followed by 75 per cent of the households who reported that pesticide use causes blister or skin rash. All the farmers of large farm and 72.22 per cent farmers of small farm were reported that pesticide use causes blister or skin rash. Further, on all farm, 74 per cent of the farmers reported that eating, drinking and smoking in the field increases the possibility of pesticides entering the body and 73 per cent of the farmers responded that vomiting diarrhea, salivation and cramps are signs of pesticides poisoning. On large farm, all the farmers were reported that pesticides exposure can cause cancer and pesticides create many health risks to pregnant women and children. Whereas on small farm, less than three fifth of farmers were responded that pesticides exposure can cause cancer and pesticides create many health risks to pregnant women and children. This implies that farmers who had large farm have shown more awareness than farmers who had small farm.

Table 1: Awareness About the Impact of Pesticides use on Human Health

Particular	Small	Large	All
Eating, drinking and smoking in the field increases the possibility of pesticides entering the body	72.22	90.00	74.00
Vomiting, diarrhea, salivation and cramps are signs of pesticides poisoning	72.22	80.00	73.00
Pesticide exposure can cause cancer	55.56	100.00	60.00
Pesticide may cause blister or skin rash	72.22	100.00	75.00
Contact with pesticides cause eye injuries	100.00	100.00	100.00
Pesticides create many health risks to pregnant women and children	55.56	100.00	60.00

It can be observed from Figure. 1 that farmers' knowledge about immediate treatment practices was high in both size of farmers. On all farm, all farmers reported that when pesticides come in contact with the eyes, eye flushing should be done. The 98 per cent and 80 per cent of the households responded that a person who swallows pesticides should take water and medicine. All the households, on small and large farm responded that a person who swallows pesticides should take water and medicine, respectively. Victims who inhaled pesticides should be shifted from pesticides area to fresh air immediately was reported by all households on large farm and 88.89 per cent of the households on small farm. This indicates that large farm sample households had more awareness regarding the immediate treatment practices for pesticides poisoning than the smaller one.

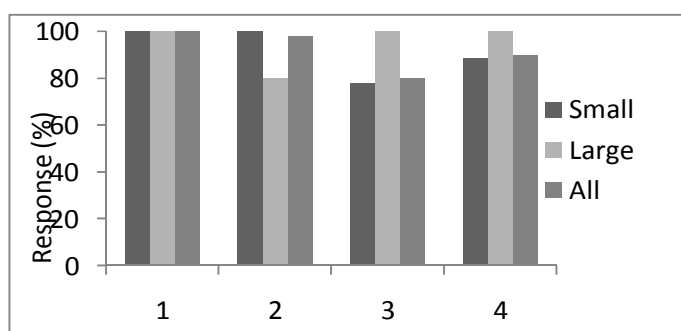


Figure.1: Awareness of Immediate Treatment Practices for Pesticide Poisoning

Note

Pesticides come in contact with the eyes, eye flushing should be done,

A person who had swallowed pesticides it is important to take water,

A person who had swallowed pesticides it is important to take medicine

Victims who inhaled pesticides should be shifted from pesticide area to fresh air immediately

On all farm situation , table 2 shows that all farmers were of the view that pesticides should be stored out of reach of children and animals, should take bath and change clothes after handling pesticides, protective clothing should be worn while mixing or applying pesticides and it is not safe to store water in containers that had been used for storing pesticides.

On all farm, four fifth of the households reported that pesticides were dangerous for people and animals'. On large farm, all the farmers responded that pesticides were dangerous for people and animals and 77.78 per cent reported the same on small farm. This indicates that on small farm, 22.22 per cent farmers were not still aware about it. On all farm, nearly half of the farmers were of the view that important instruction /warning labels on pesticides containers should be read. On small size, 44.44 percent and 80 per cent on large size farmers responded that important instruction /warning labels on pesticides containers should be read. The study shows that less than three fifths in small size farmers and one fifth large size farmers were using the pesticides containers without reading the important instruction/warning levels. Devi, (2009) also reported similar situation in Kerala.

On all farm, 60 per cent of the households who said that it is not safe to bring young children to the field after pesticide application. On large farm, all the farmers reported that it is not safe to bring young children to the field after pesticide application where as on small farm, only less than three fifth farmers responded for it. It indicates that more than two fifth farmers who had small farm don't have the awareness regarding it. The 45 per cent farmers felt that it is not good to apply pesticides on a windy day on all farm. The 50 per cent on large farm and 44.44 per cent on small farm, reported that it is not good to apply pesticides on a windy day. The remaining farmers were not aware about it. Even those farmers who have this knowledge they were also not using this while doing spray. As a result, pesticide spray applied on windy day is affecting non- target site than target one. This implies that the pesticide spray drift on windy day is associated with potential risks to human health and the environment.

On all farm, only 37 per cent farmers responded that empty pesticides container should not be kept for reuse. The 70 per cent and 33.33 per cent farmers responded that they were not using the pesticides containers for reuse on Large and Small farm, respectively. This indicates that other farmers were using pesticides containers for the reuse. It has been observed in study area while doing survey that after washing the pesticides containers farmers were using these to store for food items. This finding is similar with Dharamajal, 1997; Rengam, 1999; Ajayi, 2000 & Dharamraj and Jayapraksh, 2003. In addition, farmers wash pesticide containers under the tap of drinking water and near the open source of drinking water. Hence, the surrounding area near the water and flow of water also get contaminated. This leads to exposure of pesticides to farmers itself and water bodies. On all farm, 23 per cent of farmers responded that eating fruits directly from the tree is not safe. In large farm, 30 per cent and small farm 22.22 percent of farmer responded that eating fruit directly from tree is not safe.

Table 2: Awareness of Precautionary Measures Against Pesticides Exposure

Particulars	Small	Large	All
Pesticides should be stored out of reach of children and animals	100.00	100.00	100.00
Pesticides are dangerous for people and animals	77.78	100.00	80.00
It is important to read instructions/warning labels on pesticides containers	44.44	80.00	48.00
It is important to bath and change clothes after handling pesticides	100.00	100.00	100.00
Protective clothing should be worn when mixing or applying pesticides	100.00	100.00	100.00
It is not safe to store water in containers that have been used for storing pesticides	100.00	100.00	100.00
It is not good to apply pesticides on a windy day	44.44	50.00	45.00

Table 2: Contd.,			
It is not safe to bring young children to the field after pesticide application	55.56	100.00	60.00
Empty pesticide container should not be kept for reuse	33.33	70.00	37.00
Eating fruits directly from the tree is not safe	22.22	30.00	23.00

The sources of information (Figure.2) which influenced application of pesticides by the farmers were very diverse. Nearly all farmers received information from the pesticide sales agents on both farm. On small farm, household responded that they are receiving information from co –farmers (88.80 per cent) followed by own experience (60 per cent), television and radio (56.67 per cent), extension workers (32.22) and magazine & newspaper (11.11 per cent). Whereas, on large farm, television (80 per cent) followed by extension and radio (70 per cent), magazine and newspapers (60 per cent), own experience (40 per cent) and co-farmers (20 per cent). This indicated that extension workers playing main role only on large farm than small farm.

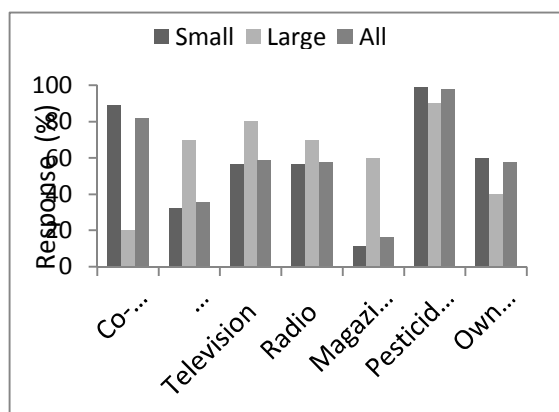


Figure.2: Sources of Information of Farmers Regarding Pesticide Application

Note

Extension- Extension workers, Magazine, New- Magazine &
Newspaper, Pesticides Sales- Pesticides Sales Agent

The response of farmers to questions on problems in apple productivity has been summarized in Figure.3. On all farm, 87 per cent of the farmers felt that productivity was decreasing while 13 per cent felt that it was increasing. On small farm, 89 per cent and 11.11 per cent farmers responded that productivity was decreasing and increasing respectively. Whereas on large farm, 70 per cent farmers responded that productivity is decreasing and 30 per cent farmers responded it was increasing.

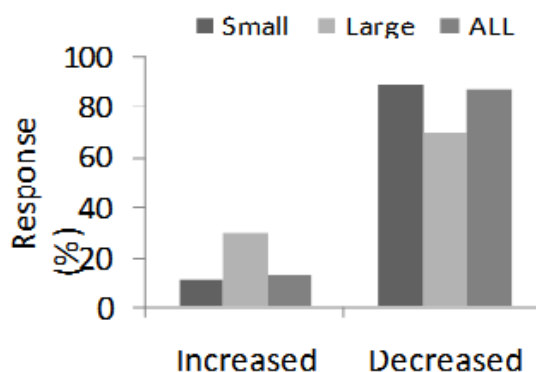


Figure.3: Farmers perception in changes in productivity

On all farm, 95 per cent of the farmers reported (figure 4) that the cost of production had increased while 5 per cent felt that it was decreasing. Out of all, on large size farms, all the farmers responded that cost of production was increasing, but on small farm, 94.44 percent farmers responded that it was increasing and for others (6 per cent) decreasing. In both farm, main reason to increase in cost of production was inferior quality of the pesticides and health problems of farm land. The reason farmers were using more doses of pesticides and agrochemicals.

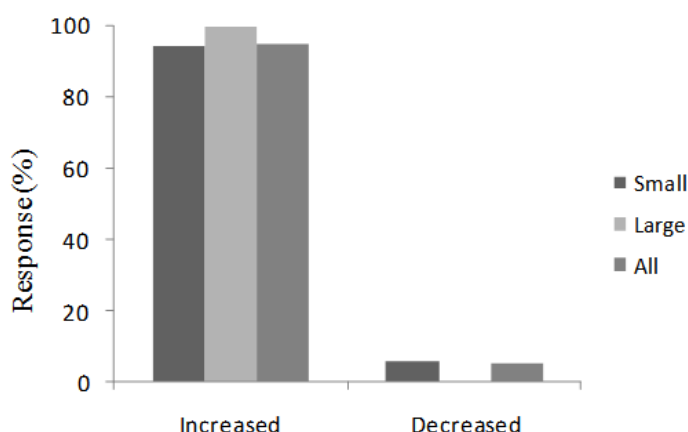


Figure.4: Farmers Perception in Changes in Cost of Production

Figure.5 indicated that it was important to note that all sample households felt that change in climate and lack of pollination mainly responsible for decrease in productivity of different crops. This is similar with the findings of Underwood (1992), Mclaughlin and Mineau (1995), Pimental, (1995) Partap (2003) & Shetty (2004). Especially apple requires insect pollination according to Underwood (1992). According to Partap, (2003) the loss in production was due crop failure. The crop failure occurs due to inadequate pollination which includes the lack of adequate number of pollinators as a result of decline in pollinator populations and diversity due to excessive and indiscriminate use of agricultural chemicals and pesticides.

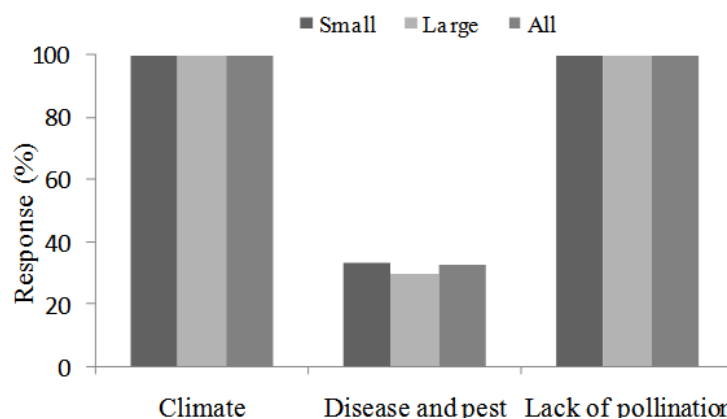


Figure.5: Farmers Perception for the Factors Affecting Productivity

Figure. 6, 7, 8 & 9 indicates the response of farmers with respect to their perceptions about the change in different parameters of climate which had contributed towards change in climate. Figure. 6 shows that on all farm 76 per cent of the households reported that there was an increase in the temperature while 24 per cent reported that there was fluctuation. On small farm size, 78 per cent farmers responded that temperature was increasing and 22.22 per cent were reported that it was decreasing. Whereas, on large farm, 40 per cent farmers responded that there was fluctuation in temperature and 60 per cent responded that it was increasing.

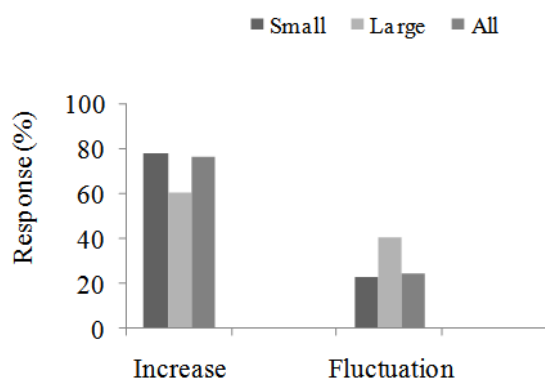


Figure 6: Farmers' Perception about Change in Temperature

Further, Figure. 7 reveals that the fluctuation in rainfall as a reason of climate change was reported by 68 per cent followed by 24 per cent decrease in rainfall and 8 per cent increase in rainfall. On small farm, 68.89 per cent farmers responded that rainfall was fluctuating and 22.22 per cent farmers reported that it was decreasing. Whereas on large farm, 60 per cent farmers responded that there was fluctuation in rainfall and 40 per cent responded that it was decreasing.

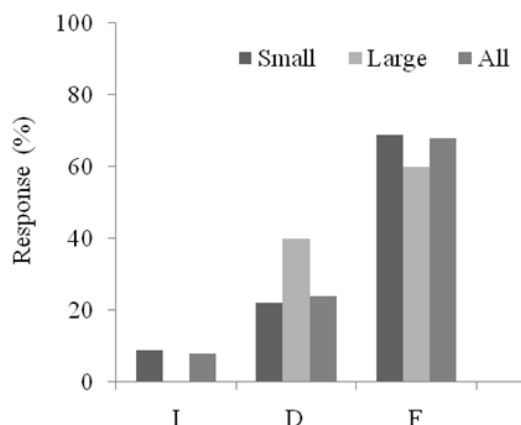


Figure 7: Farmers' Perception about Change in Rainfall

Note

I-Increase, D-Decrease and F-Fluctuation

On large farm, 80 per cent farmers responded that there was decrease in humidity and 20 per cent responded that it was fluctuating. The 66.67 per cent farmers responded that humidity was decreasing and 22.22 per cent responded that it was fluctuating (figure. 8). On all farm, the increase, decrease and fluctuation in humidity were reported by 10 per cent, 68 per cent and 22 per cent of the households, respectively.

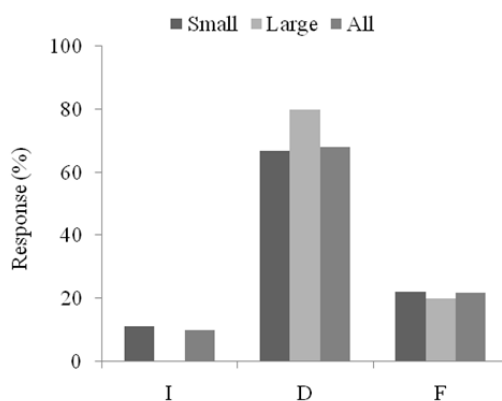


Figure 8: Farmers Perception about Change in Humidity

Note

I-Increase, D-Decrease and F-Fluctuation

Figure.9 shows that all households in study area reported that there was a decrease in snowfall due to change in climate.

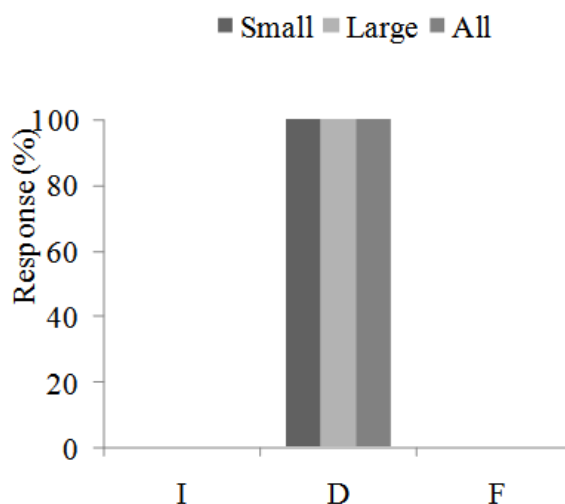


Figure 9: Farmers' Perception about Change in Snow

Note

I-Increase, D-Decrease and F-Fluctuation

The farmers of the study areas have adopted different strategies like soil management, pollination management, pollinator management and orchard management to cope up with the adverse effects of pesticides on soils and problems of decreasing productivity. Table 3 shows that under soil management practices all farmers had resorted to manuring. On overall farms, use of crop residue and droppings of sheep and goat were resorted to by 23 per cent of the households. The practice of sloping land agricultural technology was being adopted by only 9 per cent of farmers. This implies that especially the farmers are using this technology to convert grasslands into cultivable land. The practice was not very common in the study area because of very less grassland and most of the land did not have much steep slopes.

It was also noticed during the survey that only 2 per cent of the farmers were using vermi-compost fertilizers. This indicates that the practice of using vermi compost fertilizers was not popular in the study area. Table further shows that the extent of adoption of these technologies was higher on large farms in comparison to small farms. To overcome the problem of pollinator, it was found during the survey that few farmers (5 per cent) of the small families were rearing honey bees. But their sole emphasis was only honey extraction. A small proportion of large farm households (10 per cent) were hiring honey bees for pollination purpose from commercial beekeeping entrepreneurs. This practice generally found in farmers of large farm. In pollination management, on all farms, the technique of bouquet pollination was used by 75 per cent of the households and all the farmers were using branch grafting. On small farms, 75 per cent respondents were using bouquet pollination and on large farms all was using this technology. This strategy was helpful to minimize the loss of production due to the problem of pollination failure in apple crop by the indiscriminate use of pesticides impact on natural pollinator. This is similar with the finding of Partap and Partap (2002).

Table 3: Strategies Adopted by the Farmers to Minimize Adverse Effect of Climate Change and Loss of Natural Resource Base (Percent)

Particulars	Small	Large	All
1. Soil Management			
Crop residue harvesting	18.89	60.00	23.00
Manuring	100.00	100.00	100.00
Dropping of sheep and goats	18.89	60.00	23.00
Vermi compost fertilizers	2.22	0.00	2.00
Sloping agricultural land technology	5.56	40.00	9.00
Multiple cropping	100.00	100.00	100.00
2. Pollination management			
Bouquets pollination	72.22	100.00	75.00
Branch grafting	100.00	100.00	100.00
3. Pollinator Management			
Rearing honey bees	5.56	0.00	5.00
Rented honey bees	0.00	10.00	1.00
4. Orchard Management			
Pruning	100.00	100.00	100.00
Basin preparation	100.00	100.00	100.00
Basin mulching	55.56	100.00	60.00
5. Rainwater harvesting structure such as a mud pond	0.00	0.00	0.00
6. Concrete ponds for water storage	38.89	100.00	45.00
7. Mulching of nursery	22.22	30.00	23.00
8. Protection from hailstorm	0.00	0.00	0.00
9. Replacement of delicious varieties	22.22	20.00	22.00
10. Switching over to new crops	22.22	30.00	23.00

In orchard management, the pruning of plants and basin preparation was done by all the farmers. On overall farm situation, basin mulching was done by 60 per cent. Whereas on large farm, all the farmers responded for the basin mulching and on small farm 55.56 per cent farmers responded that they was doing it. For nursery mulching, on all farm, 23 per cent of the households were doing the basis mulching. On small farm, 22.22 per cent farmers responded that they was doing basin mulching and in large farm 30 responded for the same. This implies that the farmers was using less mulching practices in nursery than the basin. Those farmers who were not using mulching for the basin that was due to lack of knowledge. For nursery, all the farmers were not engaged in it. Those farmers who engaged in the nursery raising some of them were using mulching and others were using roof of plastic sheet to cover the nursery. The 45 per cent farmers responded that they had only concrete pond and using it to store drinking water. The protection measures from hail storm were not found in the area. It implies that the frequency of the hail storm was very less in the area .and switching over to new crops reported by 23 per cent of farmers. The Less response of sample farmers towards switching over to new crops or varieties was due to their lack of exposure.

CONCLUSION AND RECOMMENDATIONS

The study concluded that all the farmers those who had awareness and those who don't had awareness on the

impact of pesticide use are underestimating the use of pesticides which make an increase in agricultural production and productivity and have adverse effect on the human health and the ecosystem. Farmers on both farm had almost same perception about change in different parameters of climate. Further, less number of farmers on small farm responded for adopting strategies to minimize adverse effect of climate change and loss of natural resource base. So, the message of the study is clear. There is a need to pay attention towards promoting scientific and rational use of pesticides and other agro-chemicals to avoid environmental effects and to promote balanced use of fertilizer including bio-fertilizer for restoring soil health to protect the livelihoods of multitude of small and large farmers. The government should, therefore, undertake policy measures to strengthen extension facilities to educate farmers about environmental effects due to the use of agro-chemicals.

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